(12) UK Patent Application (19) GB (11) 2 315 559 (13) A

(43) Date of A Publication 04.02.1998

(21) Application No 9715092.4

(22) Date of Filing 18.07.1997

(30) Priority Data
(31) 9615055 (32) 18.07.1996 (33) GB
9705370 14.03.1997

(71) Applicant(s)
Weighwell Engineering Ltd

(Incorporated in the United Kingdom)

Weighwell Works, Wakefield Commercial Park, Horbury Bridge, WAKEFIELD, West Yorks, WF14 5MW, United Kingdom

(72) Inventor(s)
Paul Andrew Horsfall

(74) Agent and/or Address for Service
D A Lister & Co
5 Greenway, Honley, HUDDERSFIELD, HD7 2BZ, United Kingdom

(51) INT CL^6
G01G 19/04

(52) UK CL (Edition P)
G1W WF
U1S S1831

(56) Documents Cited
GB 1463958 A GB 1368115 A GB 0358305 A

(58) Field of Search
UK CL (Edition O) G1W WF
INT CL^6 G01G 19/04 19/06

(54) Portable apparatus for indicating load imposed by rail vehicle

(57) Portable apparatus comprises two upwardly convex shoes 12 clamped against the inner sides of an existing pair of rails 28 on a length of conventional track for engagement by the peripheries of the flanges of the wheels on a rail vehicle axle, so that the tyres of the wheels are raised just clear of the rails, a load sensing device 40 disposed at the highest portion of each shoe 12, and load indicating means connected to the load sensing devices. Each load sensing device 40 comprises a load plate 50 flush with the top of its shoe 12 and secured to a load sensing cell 42 fixed in a recess 48 in the shoe 12. The load sensing cell 42 may be supported at either end by spacers 54 with load from the load plate 50 applied near its centre, alternatively the load sensing cell 42 may be supported near its centre by spacers 54 and loaded at either end. The shoes 12 are parts of two respective frames urged apart by screw jacks. A computer indicates and records the loads. The apparatus is used in dynamically checking the loads imposed by each axle and/or wheel of a moving rail vehicle.

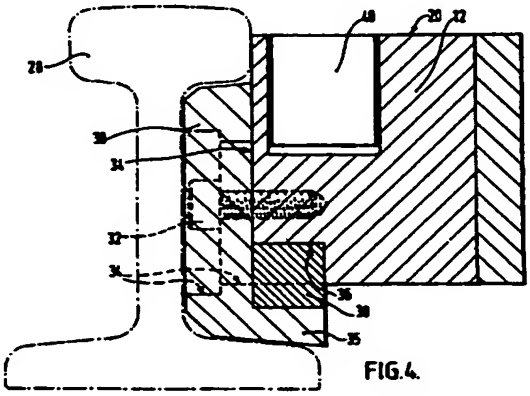

FIG.4.

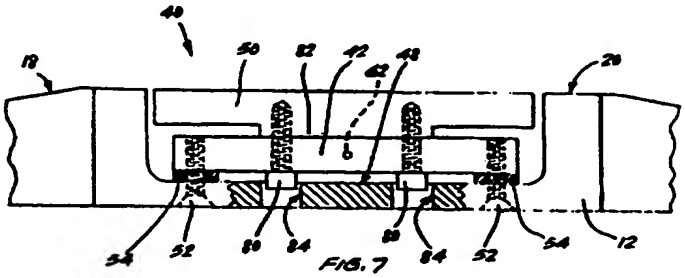

FIG.7

GB 2 315 559 A

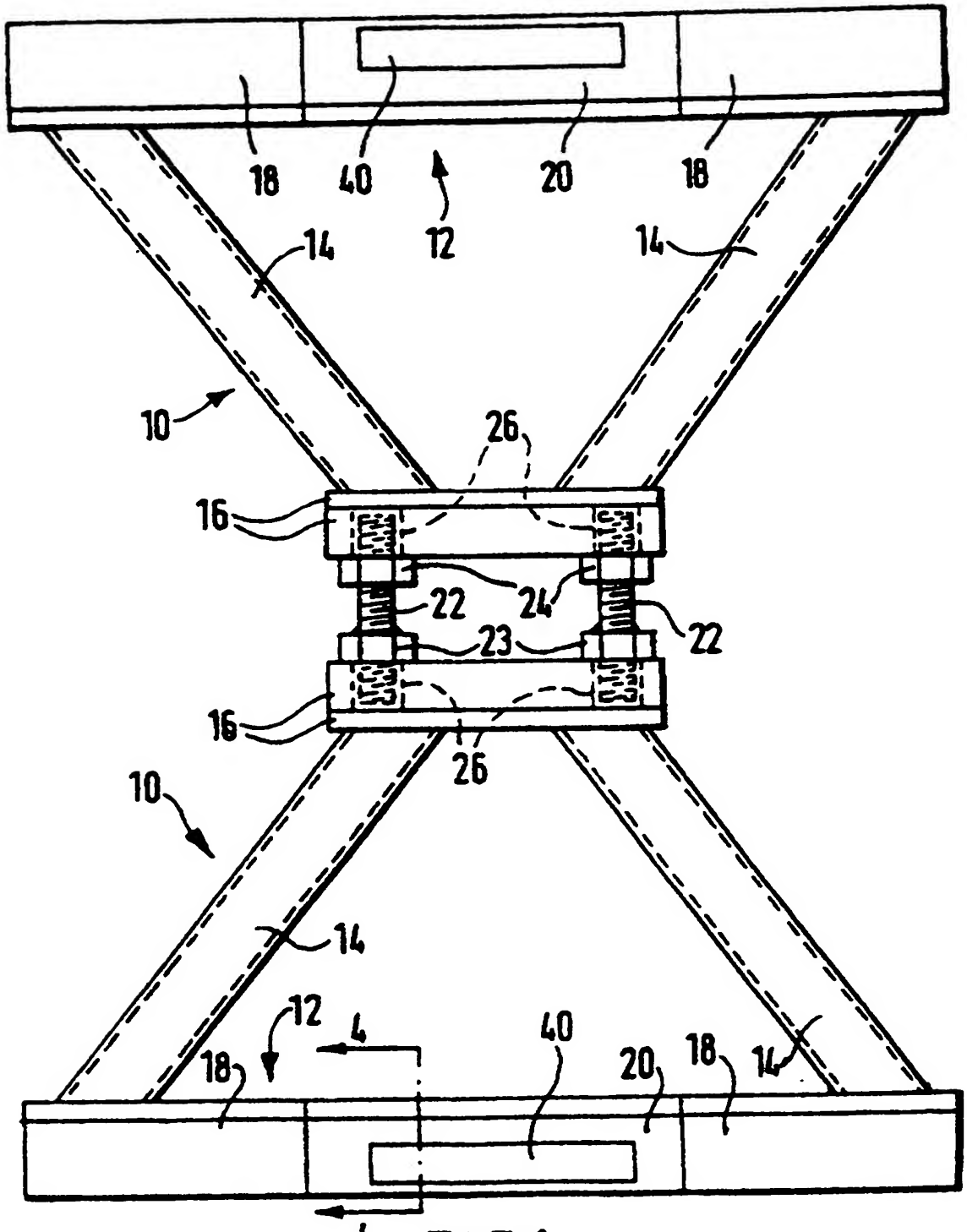

FIG.1.

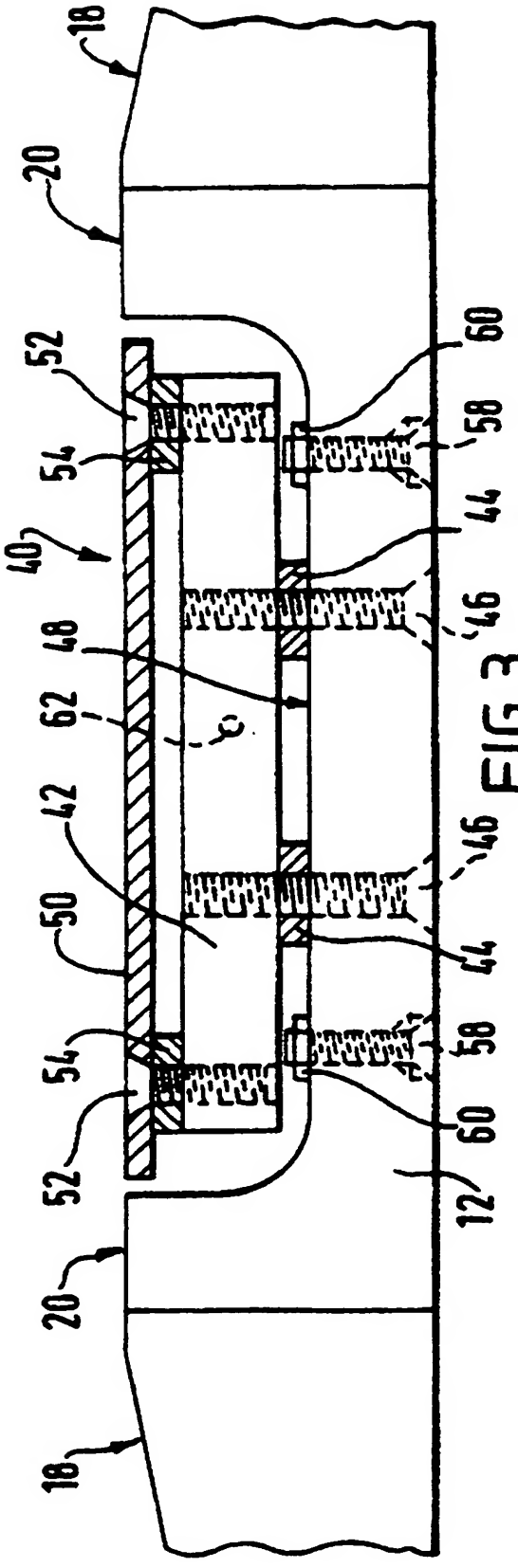

FIG.3.

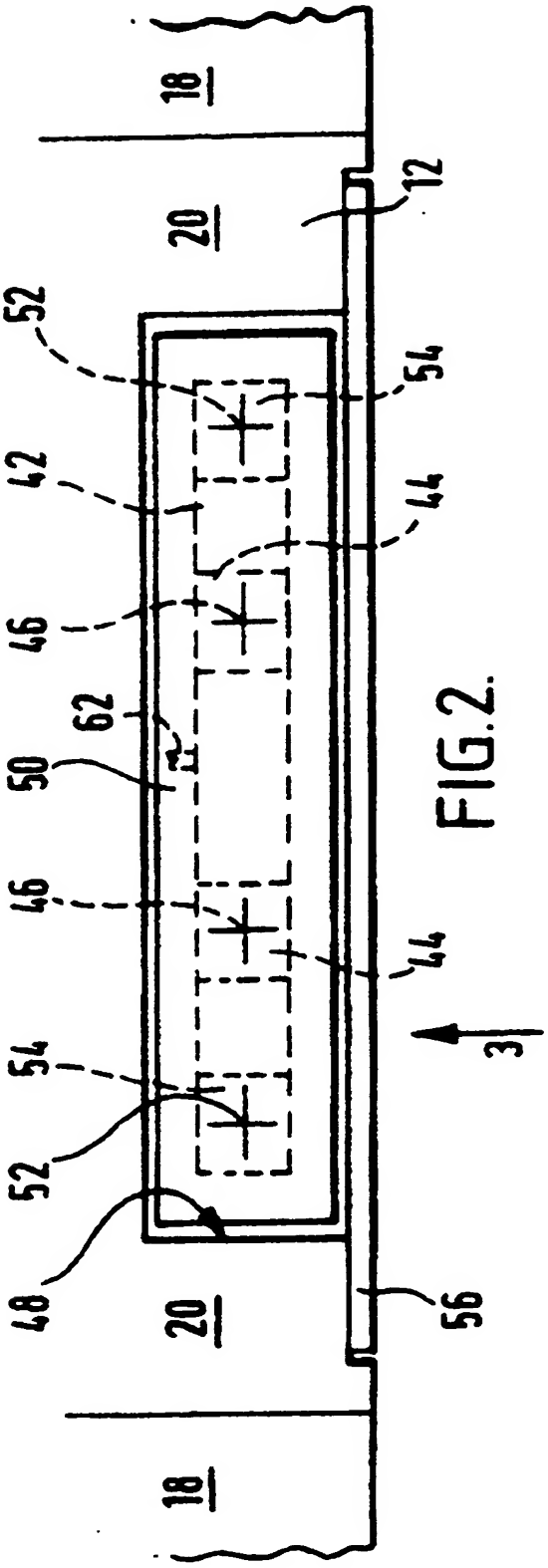

FIG.2.

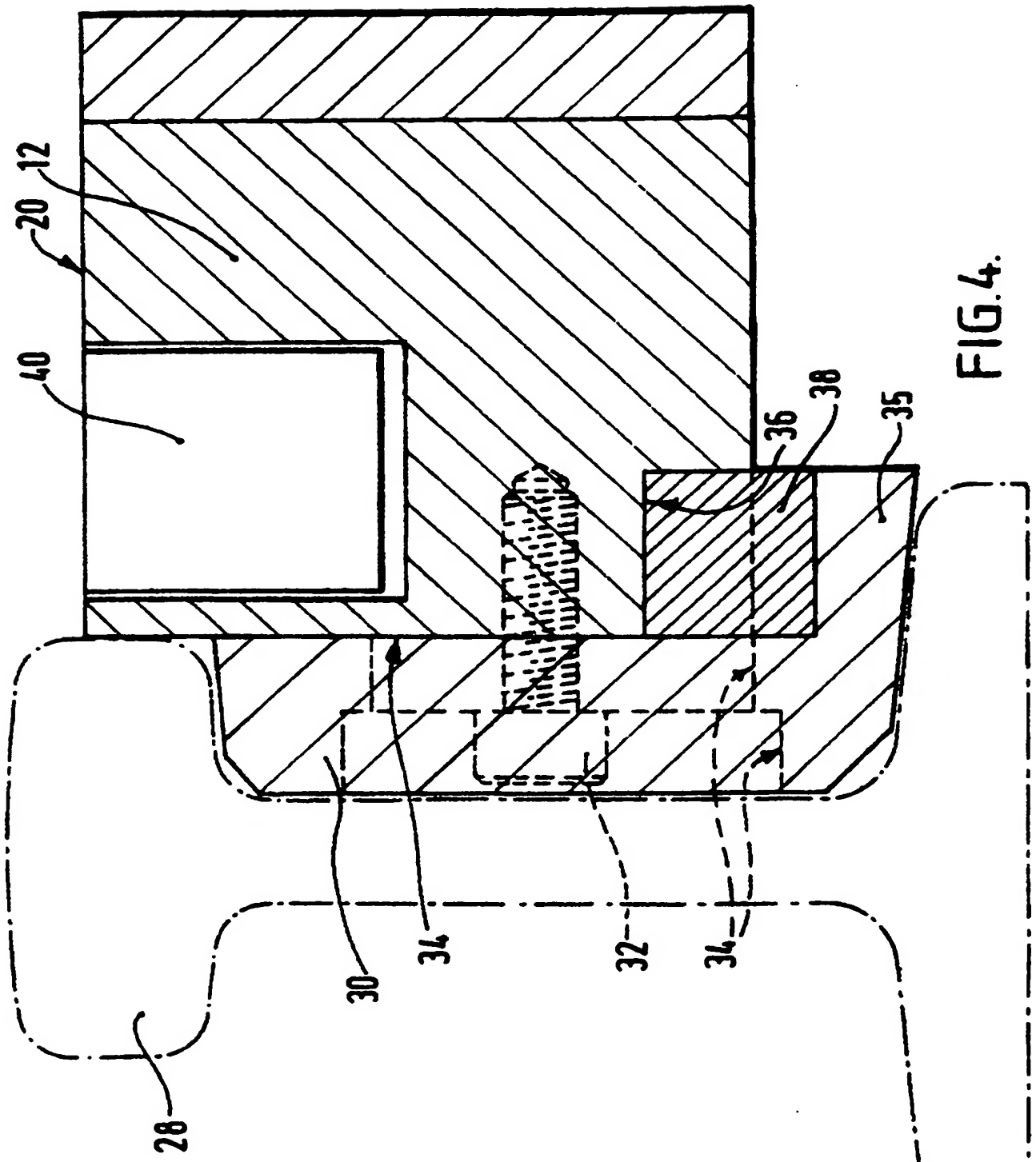

FIG.4.

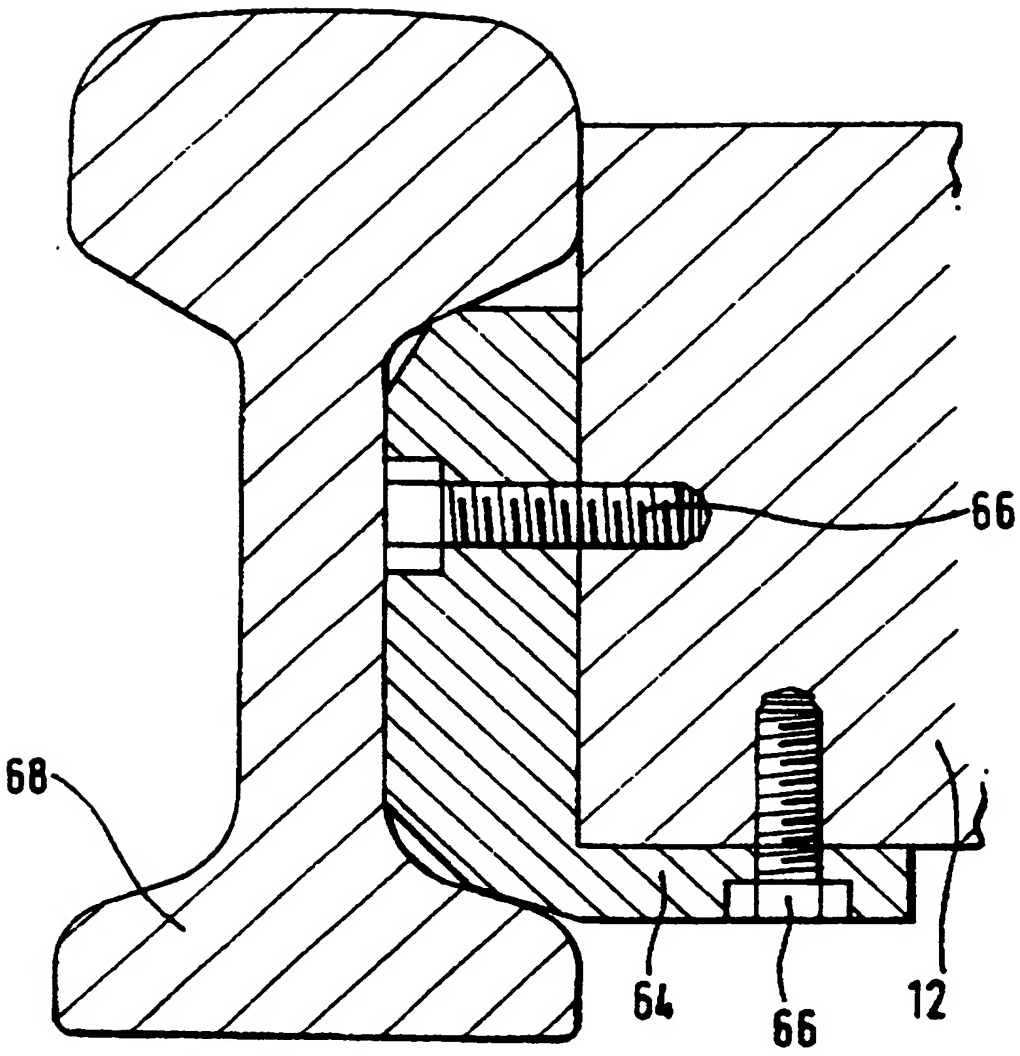

FIG. 5.

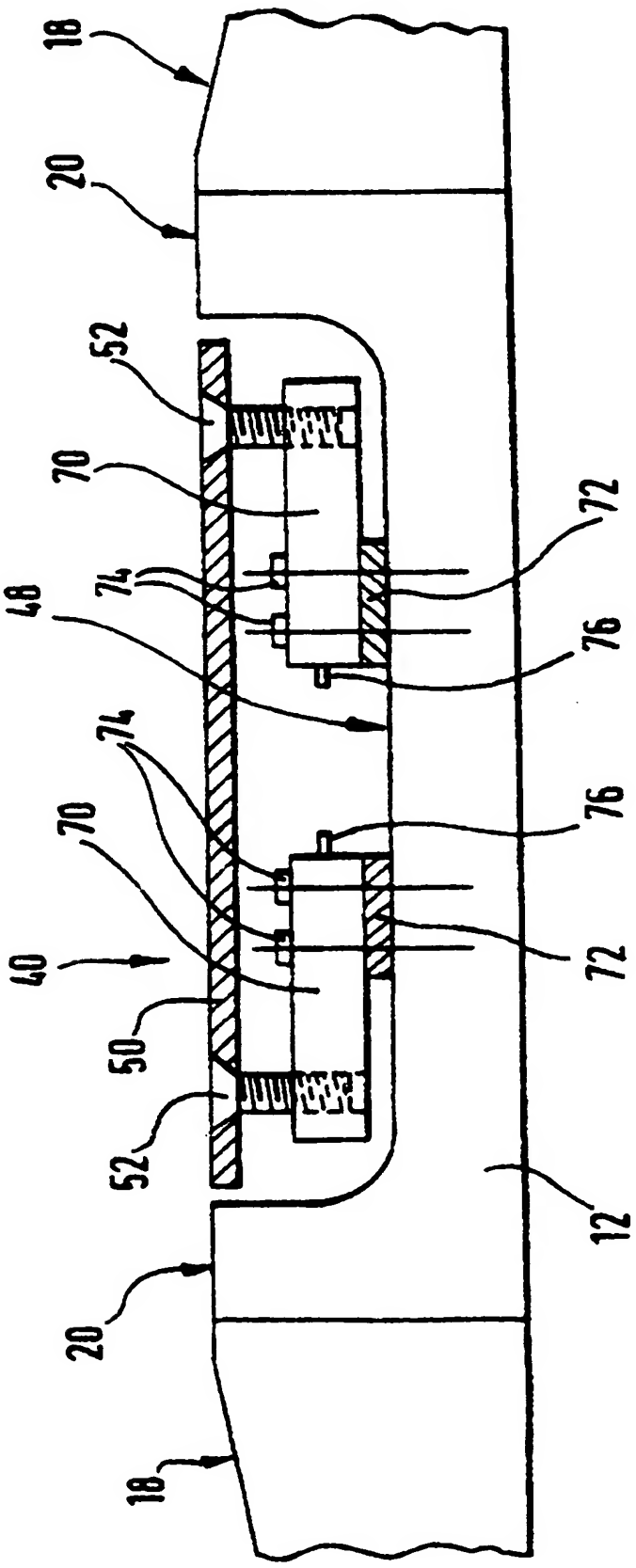

FIG.6.

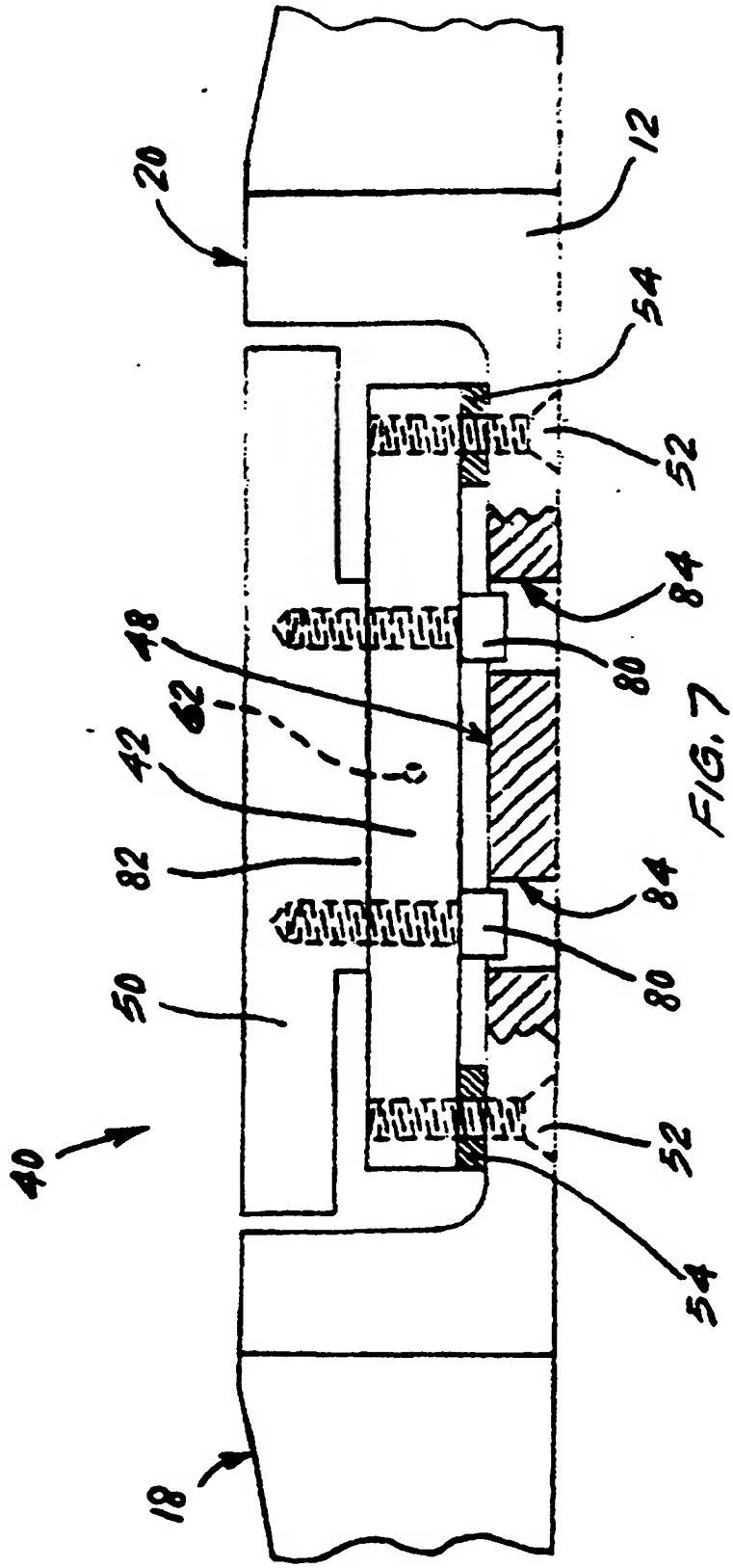

FIG. 7

"Load-Indicating Apparatus"

This invention relates to apparatus for indicating the load imposed by each axle and/or each wheel of a rail vehicle.

It is necessary to check such loads statically, for example after the assembly of a bogie, because rail track systems impose limits on the weight of rolling stock to prevent excessive wear of the rails. This has previously required a fixed installation, usually a weigh-bridge, to which the bogie must be transported. This is a time-consuming operation, and an accuracy of less than about 10 kilograms is not obtainable. Furthermore, with the advent of rail privatisation, it is likely that rail track systems will charge rolling stock operators by the weight of a train instead of by its length as at present, so that the dynamic checking of the loads imposed by all the axles of a moving train will become necessary. It is a time-consuming and costly operation to drive a whole train to a remote fixed weighing installation.

The object of the present invention is to provide portable apparatus for conveniently indicating both static and dynamic axle and/or wheel loading of a rail vehicle. A subsidiary object is to do so with enhanced accuracy.

According to the invention, portable apparatus for indicating the load imposed by each axle and/or each wheel of a railway vehicle comprises two substantially convex

carrier shoes adapted to be clamped along the adjacent sides of a pair of rails so as to be engageable by the peripheries of the flanges of the wheels on an axle whereby the tyres of said wheels are raised just clear of the rails, a load-sensing device disposed at the highest portion of each shoe, and load-indicating means connected to said devices.

Each device may comprise a load-sensing cell fixedly cantilevered about its central zone in a recess in the associated shoe, and a load-plate spaced above and rigidly secured to both cantilevered ends of said cell, the upper surface of the load-plate being flush with the highest portion of the shoe.

Alternatively, each device comprises two load-sensing cells fixedly cantilevered in a recess in the associated shoe, and a load-plate spaced above and rigidly secured to the cantilevered ends of said cells, the upper surface of the load-plate being flush with the highest portion of the shoe.

Preferably, each cell is connected by wiring to a junction box, and each junction box is connected by wiring to the load-indicating means.

An overload stop is preferably provided beneath the or each cantilevered end of each or the cell.

Alternatively, each device comprises a load-sensing cell fixedly mounted near both of its ends on spacers in a

recess in the associated shoe, and a load-plate spaced above and rigidly secured to a central zone of said cell, the upper surface of the load-plate being flush with the highest portion of the shoe.

Preferably, the load-indicating means are a computer capable of showing and recording the load imposed by individual axles and/or individual wheels.

Alternatively, the load-indicating means are a digital indicator capable of showing the load imposed by individual axles and/or individual wheels.

The shoes are preferably parts of respective frames and means are provided for urging the frames apart to clamp the shoes along the adjacent sides of a pair of rails.

Preferably, the means for urging the frames apart comprise screw jack means engageable in aligned clearance holes in the frames.

Alternatively, the means for urging the frames apart comprise at least one screwed turnbuckle device engaging in left-hand and right-hand threaded holes in the frames.

Alternatively, the means for urging the frames apart comprise a hydraulic jack.

Preferably, at least one support member is secured to each shoe so as effectively to embrace the outer and lower faces of the shoe, the or each support member being adjustable in height to suit the cross-sectional profiles

of different types of rails.

Alternatively, at least one support member is secured to each shoe so as effectively to embrace the outer and lower faces of the shoe, a range of non-adjustable interchangeable support members being provided to suit the cross-sectional profiles of different types of rails.

Two spaced-apart support members are preferably secured to each shoe.

Preferably, the shoes are provided with replaceable wear-strips aligned with the load-sensing devices for engagement by the peripheries of the flanges of the wheels.

One embodiment of the invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, of which:-

Figure 1 is a plan view of portable apparatus for indicating the load imposed by each axle and/or each wheel of a rail vehicle, with conventional electrical components omitted;

Figure 2 is a plan view on a larger scale of one form of load-sensing device forming part of said apparatus;

Figure 3 is a side elevation of the load-sensing device in the direction of arrow 3 in Figure 2, with an inspection cover omitted for clarity;

Figure 4 is a cross-section on a larger scale on the line 4-4 in Figure 1, showing how an adjustable support

member forming part of the apparatus co-acts with any height of rail;

Figure 5 is a view corresponding to Figure 4 showing a modification wherein the appropriate one of a range of non-adjustable interchangeable support members of different effective heights co-acts with one particular type of rail;

Figure 6 is a view corresponding to Figure 3 showing an alternative form of load-sensing device; and

Figure 7 is a view corresponding to Figures 3 and 6 showing another alternative form of load-sensing device.

Referring now to Figures 1 to 4 of the drawings, portable apparatus for indicating the load imposed by each axle and/or each wheel of a rail vehicle includes two generally triangular steel frames 10 each comprising a solid carrier shoe 12, two tubes 14, and an apex member 16 all welded rigidly together. Each shoe 12 is short enough to fit between adjacent rail clamps on a length of conventional track, and is substantially convex in the sense that its support face has plane end portions 18 inclined downwardly at an angle of, say, 2 to 5 degrees from its central highest plane portion 20 as best shown in Figure 3. The frames 10 are urged apart to clamp the shoes 12 along the adjacent sides of a pair of rails such as 28 (see Figure 4) by screw jack means comprising two lengths of screwed rod 22 each having a nut 23 welded near one of

its ends and a nut 24 screwable along its longer portion, the ends of the rods 22 being engageable in respective aligned pairs of clearance holes 26 formed in the apex members 16 and the arrangement being such that when clamped the nuts 23 and 24 abut against the respective apex members 16 as shown in Figure 1. These screw jack means facilitate portability of the apparatus by allowing the frames 10 to be handled separately right up to the point of use. Two spaced-apart support members or keys 30 of L-shaped cross-section are secured to each shoe 12 by respective set-screws 32. Each of said set-screws passes through a vertical slot 34 in the associated member 30 and engages in the shoe 12 so that the effective height of each member 30 is adjustable. The horizontal base portion 35 of each member 30 fits within a rebate 36 in the associated shoe 12 when minimum effective height is required to enable said member to rest on the base flange of a low-profile rail. When the apparatus is fitted to a taller rail 28 as shown in Figure 4, packing pieces or shims 38 are inserted between the horizontal base portion 35 of each member 30 and the co-operating face of the rebate 36 as required. The arrangement is such that each member 30 effectively embraces the outer and lower faces of the associated shoe 12. A load-sensing device indicated generally at 40 in Figures 1 and 4 is disposed at the highest portion 20 of each shoe 12 and, as shown in

Figures 2 and 3, comprises a load-sensing cell 42 fixedly cantilevered about its central zone on two spacers 44 by set-screws 46 in a recess 48 in the shoe and a load-plate 50, spaced above and rigidly secured by set-screws 52 and spacers 54 to the cantilevered ends of said cell, the upper surface of the load-plate 50 being flush with the highest portion 20 of the shoe. The recess 48 has an inspection cover 56 held in place by security set-screws (not shown). An adjustable overload stop consisting of a projecting end of a set-screw 58 with a lock-nut 60 is provided beneath the cantilevered end of each cell 42. Each cell is connected by wiring 62 to load-indicating means (not shown). Said means are conventional and comprise a digital indicator or a personal computer. The end portions 18 of the shoes 12 are provided with replaceable hardened inset wear-strips (not shown) aligned with the load-sensing devices 40. For maximum hardness, strength and wear-resistance, tool steel and/or armour-plating steel is employed wherever appropriate.

In operation, the apparatus is clamped between an existing pair of rails at any convenient location however remote so that its support members 30 rest on the base flanges of the rails (see Figure 4) while the upper faces of its shoes 12, and more precisely the load-plates 50 therein, are engageable by the peripheries of the flanges or toes of the wheels on an axle of a rail vehicle whereby

the tyres of said wheels are raised just clear of, say about 4 millimetres above, the rails and the load imposed by the axle is borne by the cells 42. When approaching and leaving the load-plates 50, the peripheries of the flanges of the wheels run on the aforesaid wear-strips. The flanges remain safely between the rails at all times. Both static and dynamic loading can equally well be accurately measured, a digital indicator being capable of showing the load imposed by individual axles and/or individual wheels and a computer being capable of showing and also recording said load. Where the load imposed by the axles and/or the wheels of a bogie are to be measured, a typical bogie with a total weight of around 5 tonnes is easily pushed into a checking position on the apparatus by four men.

In a modification shown in Figure 5, instead of employing adjustable support members 30 and associated rebates 36 in the shoes 12, a range of non-adjustable interchangeable support members such as 64 each secured to an associated shoe 12 by two set-screws 66 is provided to suit the cross-sectional profiles of different types of rails such as rails of different heights or the illustrated narrow-based rail 68 which requires cantilevered support for the shoe 12.

In another modification, the means for urging the frames 10 apart comprise at least one screwed turnbuckle device engaging in left-hand and right-hand threaded holes

in the frames. In an alternative modification, the means for urging the frames 10 apart comprise a manually-operated hydraulic jack. In a further modification, a single elongated support member is secured to each shoe. In yet another modification, each frame 10 includes a third tube interconnecting its shoe 12 and its apex member 16 midway between the two tubes 14. In yet a further modification, the spacers 44 and/or the spacers 54 are integral with the load-sensing cell 42. In still another modification, the spacers 44 are welded to the shoe 12.

In an alternative form of load-sensing device shown in Figure 6, each such device comprises two separate load-sensing cells 70 fixedly cantilevered on respective spacers 72 by set-screws 74 in the recess 48 in each shoe 12, the load-plate 50 being secured by set-screws 52 to the cantilevered ends of said cells. An overload stop (not shown) which may consist of a projecting end of the associated set-screw 52 is provided beneath the cantilevered end of each cell 70. Each of the cells 70 is connected by wiring 76 to a junction box (not shown), and each junction box is connected by wiring to load-indicating means (not shown). However, the previously described single load-sensing cell 42 is cheaper, stronger and simpler than the two separate cells 70.

In another alternative form of load-sensing device shown in Figure 7, each such device comprises effectively

an inversion of the load-sensing cell 42 shown in Figure 3 whereby said cell is fixedly mounted near both of its ends on two spacers 54 by set-screws 52 in the recess 48 in each shoe 12, and the load-plate 50 is disposed above the cell 42 and rgidly secured by two cap-screws 80 and spacer means 82 to a central zone of said cell, the upper surface of the load-plate 50 being flush with the highest portion 20 of said shoe. The spacers 54 are separate elements and the spacer means 82 comprise a single elongated spacer integral with the load-plate 50, but equivalent spacing arrangements can equally well be employed. The heads of the cap-screws 80 are secured by way of clearance holes 84 in the base of the recess 48. No overload stop means are provided in this form of load-sensing device, as the space between the cell 42 and the base of the recess 48 is more than sufficient to accommodate deflection of said cell resulting from the maximum load imposed on the plate 50. Each cell 42 is connected by wiring 62 to conventional load-indicating means (not shown). In this form of load-sensing device, smaller bending moments are exerted on the shoe 12 enabling the base of the recess 48 to be made shallower without risk of distortion, which in turn enables the load-plate 50 to be made deeper and therefore stronger having regard to the overall height limit dictated by the cross-sectional profile of a rail. This form of device has the further advantage that there are no

screw-heads vulnerably disposed on the upper surface of the load-plate 50.

Claims:-

1. Portable apparatus for indicating the load imposed by each axle and/or each wheel of a railway vehicle, comprising two substantially convex carrier shoes adapted to be clamped along the adjacent sides of a pair of rails so as to be engageable by the peripheries of the flanges of the wheels on an axle whereby the tyres of said wheels are raised just clear of the rails, a load-sensing device disposed at the highest portion of each shoe, and load-indicating means connected to said devices.

2. Portable apparatus according to claim 1, wherein each device comprises a load-sensing cell fixedly cantilevered about its central zone in a recess in the associated shoe, and a load-plate spaced above and rigidly secured to both cantilevered ends of said cell, the upper surface of the load-plate being flush with the highest portion of the shoe.

3. Portable apparatus according to claim 1, wherein each device comprises two load-sensing cells fixedly cantilevered in a recess in the associated shoe, and a load-plate spaced above and rigidly secured to the cantilevered ends of said cells, the upper surface of the load-plate being flush with the highest portion of the shoe.

4. Portable apparatus according to claim 3, wherein each cell is connected by wiring to a junction box, and each

junction box is connected by wiring to the load-indicating means.

5. Portable apparatus according to any one of claims 2 to 4, wherein an overload stop is provided beneath the or each cantilevered end of each or the cell.

6. Portable apparatus according to claim 1, wherein each device comprises a load-sensing cell fixedly mounted near both of its ends on spacers in a recess in the associated shoe and a load-plate spaced above and rigidly secured to a central zone of said cell, the upper surface of the load-plate being flush with the highest portion of the shoe.

7. Portable apparatus according to any one of the preceding claims, wherein the load-indicating means are a computer capable of showing and recording the load imposed by individual axles and/or individual wheels.

8. Portable apparatus according to any one of claims 1 to 6, wherein the load-indicating means are a digital indicator capable of showing the load imposed by individual axles and/or individual wheels.

9. Portable apparatus according to any one of the preceding claims, wherein the shoes are parts of respective frames and means are provided for urging the frames apart to clamp the shoes along the adjacent sides of a pair of rails.

10. Portable apparatus according to claim 9, wherein the

means for urging the frames apart comprise screw jack means engageable in aligned clearance holes in the frames.

11. Portable apparatus according to claim 9, wherein the means for urging the frames apart comprise at least one screwed turnbuckle device engaging in left-hand and right-hand threaded holes in the frames.

12. Portable apparatus according to claim 9, wherein the means for urging the frames apart comprise a hydraulic jack.

13. Portable apparatus according to any one of the preceding claims, wherein at least one support member is secured to each shoe so as effectively to embrace the outer and lower faces of the shoe, the or each support member being adjustable in height to suit the cross-sectional profiles of different types of rails.

14. Portable apparatus according to any one of claims 1 to 12, wherein at least one support member is secured to each shoe so as effectively to embrace the outer and lower faces of the shoe, a range of non-adjustable interchangeable support members being provided to suit the cross-sectional profiles of different types of rails.

15. Portable apparatus according to claim 13 or claim 14, wherein two spaced-apart support members are secured to each shoe.

16. Portable apparatus according to any one of the preceding claims, wherein the shoes are provided with

replaceable wear-strips aligned with the load-sensing devices for engagement by the peripheries of the flanges of the wheels.

17. Portable apparatus for indicating the load imposed by each axle and/or each wheel of a railway vehicle, constructed, arranged and adapted to operate substantially as hereinbefore described with reference to, and as illustrated by, Figures 1 to 4 or Figures 1,2,3 and 5 of the accompanying drawings.

18. Portable apparatus for indicating the load imposed by each axle and/or each wheel of a railway vehicle, constructed. arranged and adapted to operate substantially as hereinbefore described with reference to, and as illustrated by, Figures 1,4 and 6 or Figures 1,5 and 6 of the accompanying drawings.

19. Portable apparatus for indicating the load imposed by each axle and/or each wheel of a railway vehicle, constructed, arranged and adapted to operate substantially as hereinbefore described with reference to, and as illustrated by, Figures 1,4 and 7 or Figures 1,5 and 7 of the accompanying drawings.

The Patent Office

16

Application No:	GB 9715092.4	**Examiner:**	Martin Riley
Claims searched:	1-19	**Date of search:**	9 October 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): G1W (WF)

Int Cl (Ed.6): G01G 19/04, 19/06

Other: None.

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 1463958 A	(TOKYO) - see figures 4-9	1 at least
X	GB 1368115 A	(CONRAIL) - see figures 1,2,4,6,8,9,10	1 at least
A	GB 358305 A	(BROSCOMBE)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.